

II DESCRIPTION OF THE WILDLIFE AREA

The Sacramento River Wildlife Area is composed of a series of separate properties that extend from RM 145, one mile north of the City of Colusa, to RM 215, approximately three miles south of Woodson Bridge. The Wildlife Area is divided into thirteen Units of fee title ownership, which total 3770 acres. The Units are titled for geographic reference, utilizing names that historically applied to the general vicinity of each Unit. For the purposes of this Plan, physically separated and distinct portions of these Units are described as Subunits. There are also three conservation easements held by the Department, which total 188 acres. These three easements apply to private property and do not include the right of public access. Accordingly, these conservation easements are not mapped or located in this Plan.

All of the Wildlife Area properties are located within the floodplain of the Sacramento River and the various sites are inundated by flood waters every one to five years on average (California Department of Water Resources, 2003). The floodplain is a very dynamic area from a geomorphic perspective. These properties have been physically shaped and altered by the river over an extended period of time, as the river has meandered back and forth across the floodplain. Most of the Wildlife Area is of relatively recent origin in that the river channel has meandered across the area during the past century. This channel activity is documented by historic channel locations mapped back to 1896. These lands were within the river channel at one time and, as the channel moved, they were formed by the deposition of sediment. All of the remaining portions of the Wildlife Area were part of the river channel in the more distant past.

❖ Geographic Setting

The Wildlife Area is located within the Sacramento Valley, the northerly portion of the Great Valley of California. It is roughly midway between Sacramento and Redding. The Wildlife Area lies within a narrow corridor along the Sacramento River, which is centered in a wide alluvial valley. All Units are directly adjacent to the river and are accessible from the river. The majority of the land is within one-fourth mile of the river and greater distances are the result of relatively recent changes to the channel location. The northerly five Units are located upstream from the Sacramento River Flood Control Project where there is no system of continuous levees. Where Project levees occur, generally south of Ord Ferry, eight Wildlife Area Units are completely inside of the Project levees. The most northerly (upstream) portion is the Merrill's Landing Unit at RM 215L and the most southerly (downstream) portion of the Wildlife Area is the Colusa-South Subunit at RM 145L. Figures 2a through 2d depict the detailed location of the fee title Units of the Wildlife Area.



Figure 2a. The Sacramento River Wildlife Area - River Mile 194 to 216

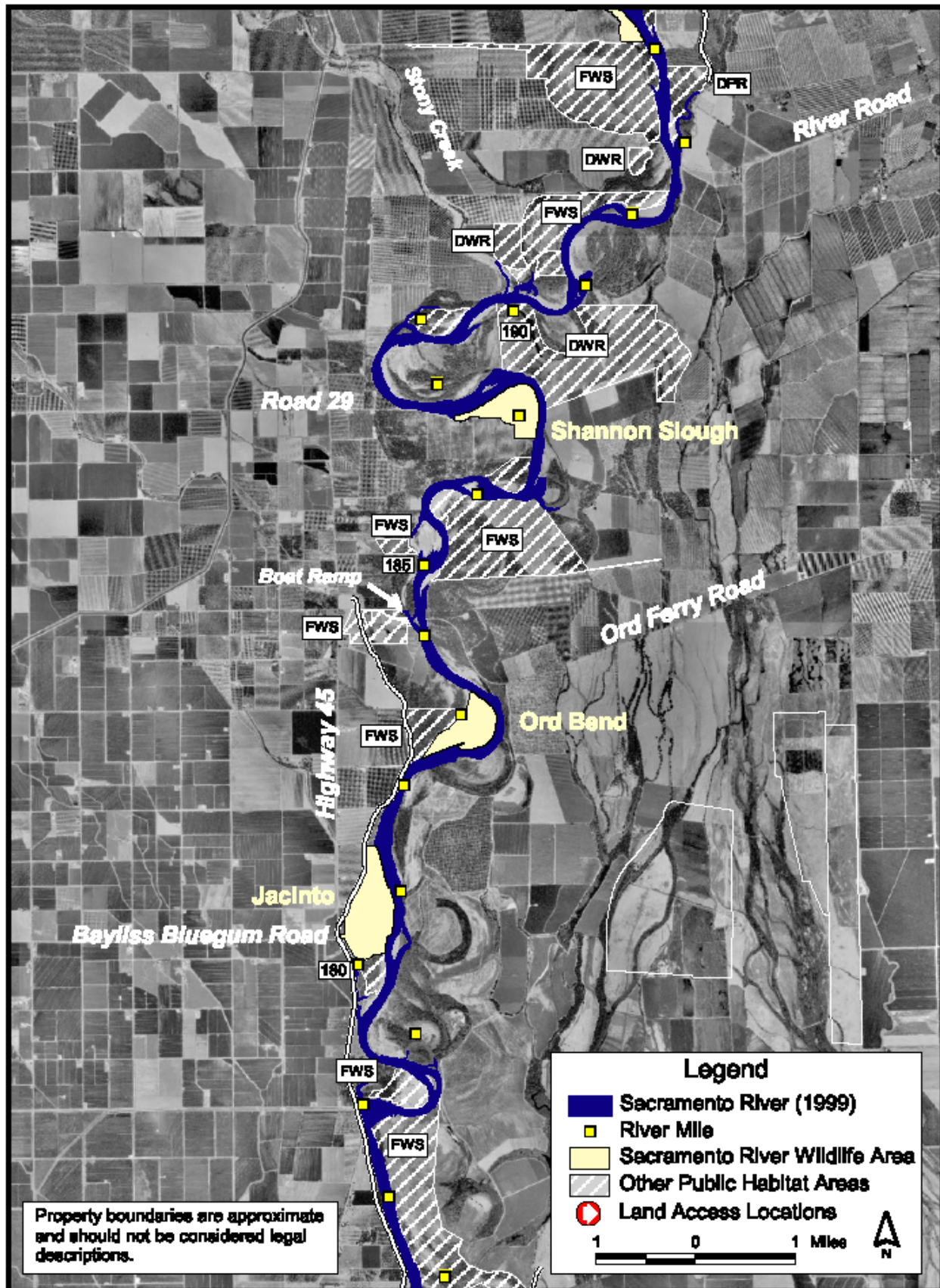


Figure 2c. The Sacramento River Wildlife Area - River Mile 177 to 194

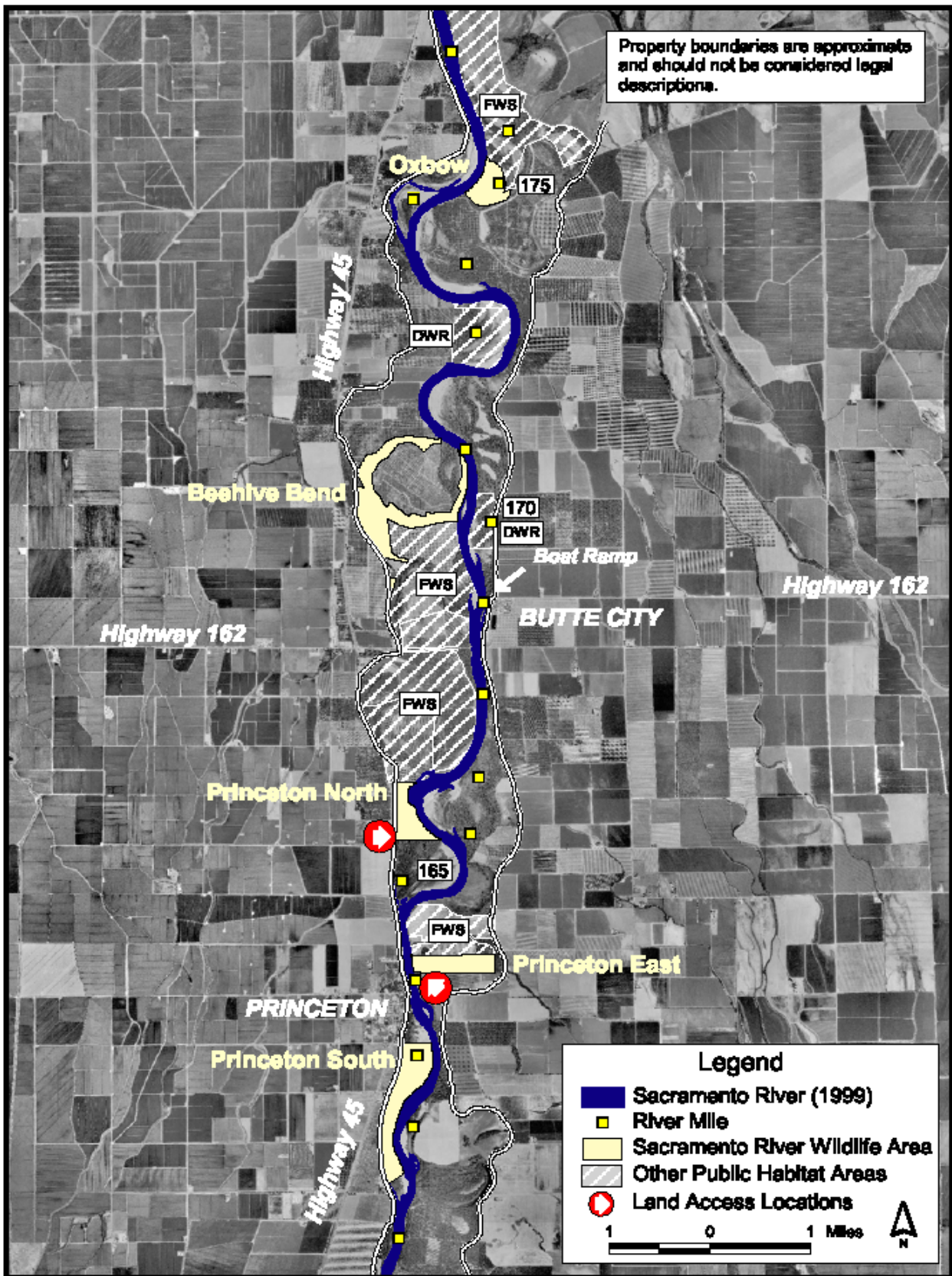


Figure 2c. The Sacramento River Wildlife Area - River Mile 161 to 177

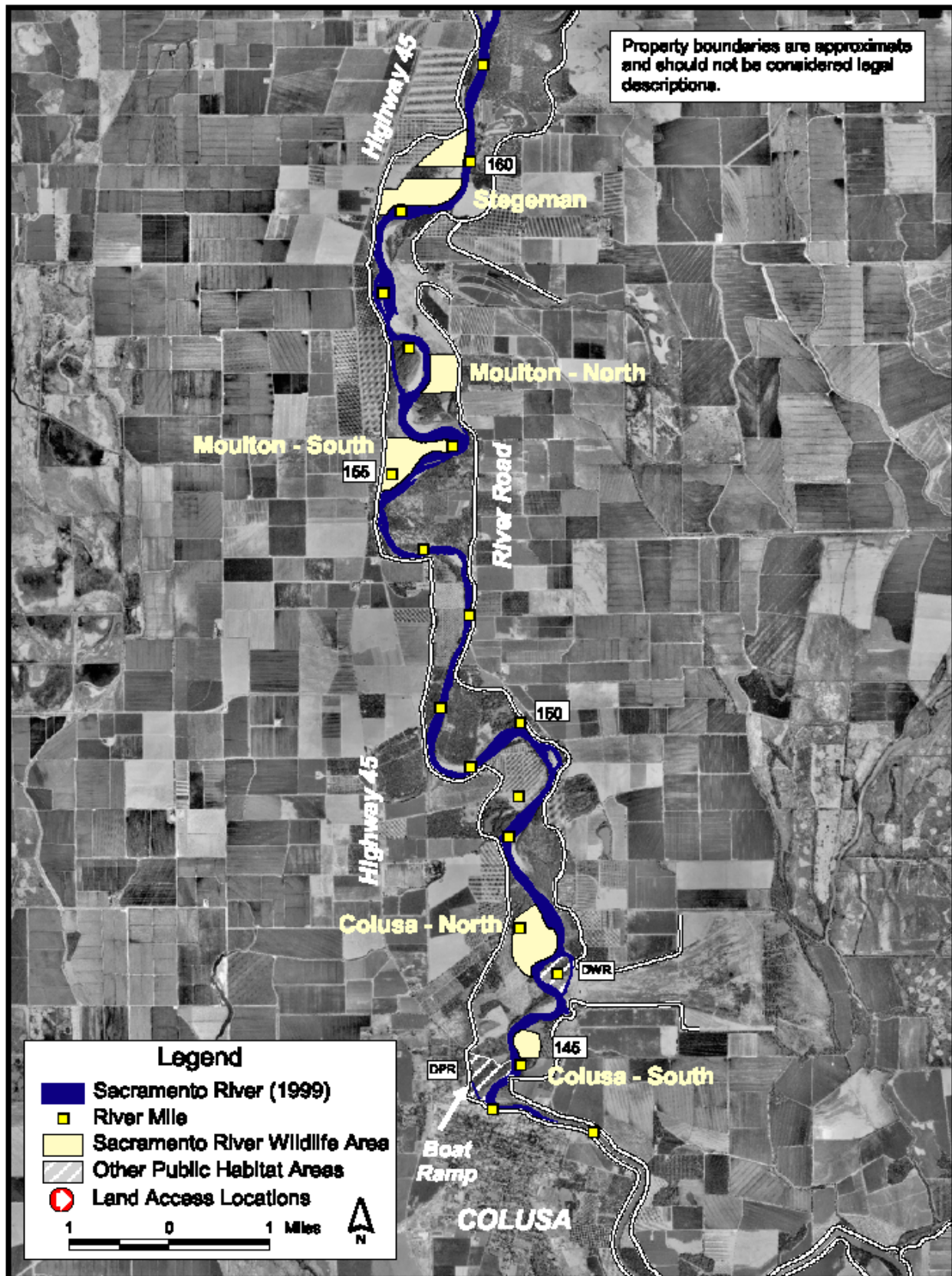


Figure 2d. The Sacramento River Wildlife Area - River Mile 144 to 161

❖ Acquisition of the Wildlife Area

The Wildlife Conservation Board is a State agency, separate and independent from the Department of Fish and Game, that acquires the property to be managed by the Department. The Wildlife Area has been acquired by the Wildlife Conservation Board over a 45-year period of time. The Wildlife Area was primarily acquired from private individuals and corporations, all of whom were willing sellers. These properties were purchased for fair market value on the basis of competent, professional appraisals, approved by the State Department of General Services. The remaining minor portion of the Wildlife Area was transferred from governmental agencies.

The Department is one of several public agencies and private organizations that manages property in support of the adopted goal of the SRCAF as expressed in the *Handbook*:

Preserve remaining riparian habitat and reestablish a continuous riparian ecosystem along the Sacramento River between Redding and Chico and reestablish riparian vegetation along the river from Chico to Verona.

Other significant managers of habitat property include USFWS, DPR, the Reclamation Board, the Bureau of Land Management, River Partners and TNC. The total area of land that has been reserved for habitat conservation in the entire SRCA is approximately 22,000 acres. The Department works in partnership with these other entities to promote the Goal of the SRCAF. Chapter IV describes the programs of other managers of habitat property and the ongoing coordination that occurs.

The initial portion of the Wildlife Area, 50 acres that is now a part of the Princeton – North Subunit, was acquired in 1958. Two properties totaling 333 acres were acquired in 1978 and four properties, totaling 783 acres, were acquired in 1986 and 1987. The remaining area of about 2600 acres was acquired between 1989 and 1995 to bring the Wildlife Area to a total of 3770 acres. These property acquisitions were funded through a number of State sources, primarily bonds that were approved by the voters of California for purposes that included habitat conservation and recreation. The utilization of these funds for habitat acquisition was reviewed and approved by the Wildlife Conservation Board. Table 2 details the acquisitions that formed the Wildlife Area and the funding sources that were utilized.

The conservation easements were likewise purchased from willing sellers for the fair market value of the property rights that were transferred. Conservation easements involve the transfer of certain specified property rights. The landowner retains fee title ownership of the property and all the property rights that are not sold as part of the transaction. Each of the three conservation easements are unique documents that reflects the objectives of the fee title owner of the property at the time of the transaction. Generally, conservation easements commit the landowner to maintain the habitat value of the subject property. For example, a property that is in riparian habitat would typically be kept in that habitat under a conservation easement. Such easements may also permit continuation of agricultural use subject to the limit that the land cannot be developed for more intensive use. All transferred rights, which become binding limitations on the fee title ownership, are specified in the easement deed. The Department is also provided the right to access the property and verify that the easement provisions are being met. The decision to sell either a conservation

Table 2. Acquisition History of the Wildlife Area

Unit	Subunit	Year	Record Acres	Parcel History No.	Fund Source for Acquisition ¹
Fee Title Land					
Princeton	North	1958	50	820202	447
Jacinto	-	1978	183.1	820401	733
Shannon Slough	-	1978	150	820413	733
Merrill's Landing		1979	295.5	820432	742, Federal LWCF
Pine Creek	North	1984	371.7	820691	447
Pine Creek	-	1987	118.3	820771	140
Pine Creek	West	1987	7.9	821252	140
Wilson Landing	-	1986	285.5	820825	140
Dicus Slough	-	1989	20.1	820902	140
Jacinto	-	1989	99.7	820919	786
Stegeman	-	1990	88.3	820962	786
Moulton	South	1990	131.2	820963	786
Stegeman	-	1990	66.2	820976	786
Merrill Landing	-	1990	172.3	820990	786
Beehive Bend	-	1991	88.3	821015	786
Princeton	North	1991	46.8	821058	786
Princeton	East	1991	100.3	821092	786, 999-Mitigation
Beehive Bend	-	1991	109.6	821100	786
Ord Bend	-	1991	112.1	821107	786
Moulton	North	1991	106	821121	786
Pine Creek	West	1991	185.6	821122	786
Pine Creek	West	1991	159.3	821257	786
Dicus Slough	-	1991	25	821123	786
Pine Creek	East	1991	20	821149	786
Pine Creek	East	1991	198.7	821150	786
Oxbow Unit	-	1992	94.1	821148	786
Princeton	South	1992	227.8	821230	786
Dicus Slough	-	1993	98.7	821239	786
Colusa	South	1994	44.5	821334	786
Princeton	North	1994	23.3	821356	997-Donation
Colusa	North	1994	118	821359	262, 447
Merrill Landing	-	1995	1	821456	998-Exchange
Conservation Easements					
"A"	-	1987	76.2	820800	140
"B"	-	1993	25.3	821335	786
"C"	-	1994	87.1	821360	262

¹Fund Key

Fund	140	Environmental License Plate Fund
	262	Habitat Conservation Fund
	447	Wildlife Restoration Fund
	733	Beach, Park Recreation and Historical Facilities Fund
	742	Urban and Coastal Park Fund
	786	California Wildlife, Coastal and Park Conservation Act
	997	Donation (from Farmer's Home Administration)
	998	Exchange (for property in the Stegeman Unit)
	999	Mitigation (DWR mitigation site)
	LWCF	Federal Land and Water Conservation Fund

easement or fee title ownership of a property is one that is made by the landowner as part of property negotiations.

It is anticipated that additional property may be added to the Wildlife Area in the future, consistent with the purposes of this Plan. However, any such acquisition will be a subsequent determination that cannot precisely be predicted at this time. Future acquisitions may include fee title purchase or donations as well as acquisition of conservation easements through purchase or donation. Priorities for acquisition include lands with significant habitat value and lands that will expand or fill gaps in areas of public habitat conservation. Consistent with the Principles of the Sacramento River Conservation Area Forum, expanded habitat areas will help to address the impacts of habitat fragmentation and permit better accommodation of the natural river processes that create and maintain habitat.

❖ **Property Boundaries and Adjacent Land Uses**

The land area of the various Units within the Wildlife Area has changed over the years as the meandering of the river channel has eroded some areas and deposited new land in other areas. This dynamic situation will continue in the future. An estimate of the current land area of each Unit and Subunit of the Wildlife Area was developed utilizing Arc View version 3.2 software and aerial photography dated May, 1999, that is contained in the Sacramento River Geographic Information System (SRGIS). The purpose of this area estimate was to provide a reasonably current determination of land area for planning purposes.

Every Unit of the Wildlife Area is adjacent to the Sacramento River. On the land, the Units abut both private and public land ownership. The public or private nature of ownership and land use of the adjacent land was determined as part of the Site Inventory that was prepared part of the Planning Process. The evaluation of adjoining land use, which was prepared as part of the Site Inventory, indicates that approximately 55% of the Wildlife Area directly adjoins areas of riparian habitat. Approximately 40% adjoins areas of agriculture crops and about 5% of the Wildlife Area adjoins levees with roads or highways adjacent to them.

❖ **Unit Descriptions**

The Wildlife Area includes existing riparian habitat and property that was formerly riparian habitat, prior to conversion to other use. Approximately 75% of the fee title portion of the Wildlife Area is natural riparian habitat and about 13% has been replanted to riparian habitat. The remaining area, approximately 432 acres or about 11.5% of the total area, is composed of relatively low value habitat that has not naturally developed into riparian habitat with a high value for wildlife. Such areas are typically dominated by remnant, abandoned orchards or nonnative invasive species. The conservation easement area is about one-half in agriculture and one-half in riparian habitat. Table 3 specifies the generalized habitat composition of the Wildlife Area.

A detailed Site Inventory was prepared as an information base for the Planning Process and the ongoing management of the Wildlife Area. This document consolidated and summarized information from SRGIS, numerous published technical sources, site analysis and various technical studies conducted by TNC. The information relates to Geomorphology, Hydrology, Botany, Biology, Archaeology and other fields of technical relevance. The Site Inventory is included

Table 3. Generalized Habitat Composition of the Wildlife Area

Unit	Subunit	Current	River Mile	Habitat Composition (acres)		
		Area (acres)		Native ¹	Restored ²	Unrestored ³
Fee Title Land						
Merrill's Landing	-	473	213 - 215.5 L	343	-	130
Dicus Slough	-	155	209 L	75	-	80
Wilson Landing	-	338	203 - 205 L	173	-	165
Pine Creek	North	331	196 - 198 L	331	-	-
	West	463	194 - 197 R	228	235	-
	East	197	194.5 - 195.5 L	155	-	42
Shannon Slough	-	144	187 R	144	-	-
Ord Bend	-	136	183 R	136	-	-
Jacinto	-	242	180 - 181 R	204	38	-
Oxbow	-	76	175 L	76	-	-
Beehive Bend	-	269	170 - 171 R	211	58	-
Princeton	North	86	166 R	36	50	-
	East	95	164 L	51	44	-
	South	194	161.5 - 163 R	160	34	-
Stegeman	-	194	159 - 160 R	184	-	10
Moulton	North	74	157L	28	46	-
	South	125	155 – 156 R	125	-	-
Colusa	North	136	146 – 147 R	131	-	5
	South	42	145 L	42	-	-
Total		3770		2833	505	432
Percent of the Total Area				75.1%	13.4%	11.5%
Conservation Easements						
“A”		25	145 +/-	-	-	25
“B”		87	147+/-	20	-	67
“C”		76	150+/-	76	-	-
Total		188		96	0	92
Percent of the Total Area				51.1%	0.0%	48.9%

Notes: ¹ Native habitat is composed of natural Great Valley Riparian Forest and related communities.

² Restored habitat is composed of replanted Great Valley Riparian Forest and related communities.

³ Unrestored habitat is composed of low value habitat where replanting has not occurred.

as Appendix C. A brief overview of each Unit and Subunit of the Wildlife Area has been compiled from the Site Inventory to provide a description of each separate property in the Wildlife Area.

Within these descriptions, the defined term Low Terrace is used to describe low-lying areas that have been deposited by the river over the past century and commonly flood annually. They are primarily areas of natural riparian habitat and have generally not been used for agriculture, due to their low-lying nature and dense vegetation. They often contain sloughs, oxbow lakes and other water features that are important to fish and wildlife species. The defined term High Terrace is used to describe higher land areas that have generally existed since before 1900. Such areas have often been cleared for some agricultural use in the past. These sites generally have a flood frequency of two to five years.

- ◆ **Merrill's Landing Unit** – 473 acres at RM 213 to 215.5L (see Figure 2a)
This Unit incorporates the Merrill's Landing Wildlife Area and is composed of a central High Terrace surrounded by a Low Terrace that was the main river channel until the late 1970's. It features dense riparian forest, grass lands, riparian scrub area, an oxbow lake and a large gravel bar that provides access from the river. Access to a very small portion of the site is available on the West Side of Ballard Road, just below the Butte-Tehama County line. The majority of the site is accessible only from the river. The site is located approximately 3 miles downstream of the boat ramp at the Tehama County Park at Woodson Bridge.
- ◆ **Dicus Slough Unit** – 155 acres at RM 209L (see Figure 2a)
This Unit is composed of an easterly High Terrace and a Low Terrace on the west. It features dense riparian forest, grasslands, riparian scrub, a slough with permanent water and a large gravel bar that provides access from the river. Access is limited to the river and the site is located approximately 9 miles downstream of the boat ramp at the Tehama County Park at Woodson Bridge.
- ◆ **Wilson Landing Unit** – 338 acres at RM 203 to 205L (see Figure 2a)
This Unit is composed of a central High Terrace surrounded by a Low Terrace that was the main river channel until the late 1970's. It features dense riparian forest grasslands, an oxbow lake and small gravel bars that provide access from the river. Access is limited to the river. The site is located approximately 5.5 miles upstream of the boat ramp at the Irvine Finch Unit of the State Park.
- ◆ **Pine Creek-North Subunit** – 331 acres at RM 196 to 198L (see Figure 2a)
This Unit is a Low Terrace that features dense riparian forest and a gravel bar that provides easy access from the river. Access is limited to the river and the site is located approximately one and one-half miles downstream of the boat ramp at the Irvine Finch Unit of the State Park.
- ◆ **Pine Creek-West Subunit** – 463 acres at RM 194 to 197R (see Figure 2a)
This Unit is a Low Terrace that features dense riparian forest, riparian scrub, approximately 235 acres that were restored to riparian habitat in 2002 and a large gravel bar that provides easy access from the river. Land access to a small portion of the site is available from Glenn County Road 23, east of Highway 45, with a trail that connects to the river during dry months. The site is located approximately 2.5 miles downstream of the boat ramp at the Irvine Finch Unit of the Bidwell-Sacramento River State Park.
- ◆ **Pine Creek-East Subunit** – 197 acres at RM 194.5 to 195.5L (see Figure 2a)
This Unit is primarily a Low Terrace that features dense riparian forest, an oxbow area with seasonal and permanent water, 42 acres of abandoned orchards and a large gravel bar that provides easy access from the river. Land access is available from River Road in Butte County via a primitive trail located on the north side of the administration compound for the Bidwell-Sacramento River State Park, approximately .2 miles south of Sacramento Avenue. The site is located approximately four miles downstream of the boat ramp at the Irvine Finch Unit of the State Park.
- ◆ **Shannon Slough Unit** – 144 acres at RM 187R (see Figure 2b)
This Unit is a Low Terrace that features dense riparian forest, slough areas with seasonal and permanent water, scrub area with a gravel base and a large gravel bar that provides easy access from the river. Access is only from the river and

the site is located approximately four miles upstream of the boat ramp at the Ord Bend County Park.

- ◆ **Ord Bend Unit** – 136 acres at RM 183R (see Figure 2b)
This Unit is a Low Terrace that features dense riparian forest, a scrub area with a gravel base and a large gravel bar that provides easy access from the river. Access is only from the river and the site is located approximately one mile downstream of the boat ramp at the Ord Bend County Park.
- ◆ **Jacinto Unit** – 242 acres at RM 180 to 181R (see Figure 2b)
This Unit is primarily a Low Terrace with some High Terrace area. It features dense riparian forest, approximately 38 acres that were restored to riparian habitat in 2000 and a gravel bar that provides easy access from the river. Access is limited to the river and the site is located approximately three and one-half miles downstream of the boat ramp at the Ord Bend County Park.
- ◆ **Oxbow Unit** – 76 acres at RM 175L (see Figure 2c)
This Unit is a Low Terrace that features dense riparian forest, scrub area with a gravel base and a surrounding oxbow with some permanent water. The site is relatively isolated and infrequently visited. There are no gravel bars and access is only from the river. The site is located approximately six miles upstream of the boat ramp at Butte City.
- ◆ **Beehive Bend Unit** – 269 acres at RM 170 to 171R (see Figure 2c)
This Subunit is a combination of Low and High Terraces. It features dense riparian forest, a large oxbow lake and a slough, approximately 58 acres that were restored to riparian habitat in 2000 and a gravel bar. Access is limited to the river and the site is located approximately one and one-half miles upstream of the boat ramp at Butte City.
- ◆ **Princeton-North Subunit** – 86 acres at RM 164L (see Figure 2c)
This Subunit is a combination of Low and High Terraces. It features approximately 23 acres that were restored to riparian habitat in 1992 and 27 acres that were restored in 2000. The remainder of the area is dense riparian forest and there is an inholding, a private residence located within the site. The area can be accessed from the river at a gravel bar and it is located approximately three miles downstream of the boat ramp at Butte City. Land access is also available off of the east side of Highway 45, approximately 1.3 miles north of the Town of Princeton. A parking area and trail known as the “Site 21 Fishing Access” is maintained by Glenn County pursuant to a long term Operating Agreement with the Wildlife Conservation Board.
- ◆ **Princeton-East Subunit** – 95 acres at RM 164L (see Figure 2c)
This Subunit is primarily a High Terrace. It features approximately 34 acres that were restored to riparian habitat in 1992 and the remainder of the area is natural riparian forest with an scrub area adjacent to the river. The site can be accessed from the river though there is no gravel bar. The site is located approximately five miles downstream of the boat ramp at Butte City. Land access is also available from Glenn County Road XX, across the river from the Town of Princeton.
- ◆ **Princeton-South Subunit** – 194 acres at RM 161.5 to 163R (see Figure 2c)
This Subunit is primarily a Low Terrace with some High Terrace area. It features dense riparian forest, approximately 34 acres that were restored to riparian habitat in 2001 and a large gravel bar that provides easy access from the

river. Access is limited to the river and the site is located approximately six miles downstream of the boat ramp at Butte City.

- ◆ **Stegeman Unit** – 194 acres at RM 159 to 160R (see Figure 2d)
This Unit is primarily a Low Terrace that includes two parcels that are separated by a private ownership about 600 feet in width. It features dense riparian forest, ten acres of abandoned orchard, open grassland with a gravel base and a large gravel bar that provides easy access from the river. Access is limited to the river and the site is located approximately ten miles downstream of the boat ramp at Butte City.
- ◆ **Moulton-North Subunit** – 74 acres at RM 157L (see Figure 2d)
This Subunit is located on a High Terrace with no gravel bar area. It features approximately 42 acres that were restored to riparian habitat in 2001 and the remainder of the site is natural riparian habitat. Access is limited to the river and the site is located approximately thirteen miles upstream of the boat ramp at the Colusa-Sacramento River State Recreation Area.
- ◆ **Moulton-South Subunit** – 125 acres at RM 155 to 156R (see Figure 2d)
This Subunit is primarily a Low Terrace. It features dense riparian forest, open grassland with a gravel base and a small gravel bar. Access is limited to the river and the site is located approximately twelve miles upstream of the boat ramp at the Colusa-Sacramento River State Recreation Area.
- ◆ **Colusa-North Subunit** – 136 acres at RM 146 to 147R (see Figure 2d)
This Subunit is primarily a Low Terrace. It features dense riparian forest, a small slough that holds seasonal water, five acres of abandoned orchard and a large gravel bar that provides easy access from the river. Access is limited to the river and the site is located approximately two miles upstream of the boat ramp at the Colusa-Sacramento River State Recreation Area.
- ◆ **Colusa –South Subunit** – 42 acres at RM 145L (see Figure 2d)
This Subunit is a Low Terrace that is entirely a dense riparian forest with a slough that holds seasonal water. There are no gravel bar areas. Access is only from the river and the site is located approximately one mile upstream of the boat ramp at the Colusa-Sacramento River State Recreation Area.

❖ Natural Environment

The Sacramento River has continually meandered across its alluvial valley transforming the landscape and supporting a unique riparian ecosystem within its floodplain. The natural process of channel meander involves constant change through erosion and deposition of sediment. Some of the major factors that drive this meander pattern include the type of river bed and bank sediment, the flow regime of the river, the type of vegetation and land use occurring on the floodplain, and artificial constraints to channel movement. The *Sacramento River Conservation Area Handbook*, Chapter 2, contains an overview of the natural processes that create and modify the riparian habitat along the river. Much of the material within this section is adapted from the *Handbook* with the input of Department biologists and TNC science staff.

Climate – The climate of the middle Sacramento Valley is classified as Mediterranean. It is characterized by cool, wet winters and hot, dry summers.

Rainfall is distributed throughout the winter season, often occurring in steady two and three day storms. The mean annual temperature is 61.7°F and the record extremes are 118°F and 15°F. South winds are generally associated with storms in the winter and cooling trends in the summer. North winds are generally associated with dry conditions in the winter and hot and dry conditions in the summer.

Geology and Soils – The portion of the Wildlife Area north of Chico Landing (RM 193) is underlain by sedimentary and volcanic deposits including the Tehama and Tuscan Formations. On top of these formations lie terrace deposits such as the Riverbank and Modesto Formations, as well as paleochannel deposits, meanderbelt deposits and bank and marsh deposits. The Modesto and Riverbank deposits flank the river in steps away from the channel and tend to erode at lower rates than younger deposits. These areas also tend to form higher more consolidated banks and have a higher proportion of better quality Columbia and Vina soils. Substantial portions of the Units in this area are classified by the Natural Resources Conservation Service (NCRCS) as Riverwash, which has a very limited capability to support either crops or dense riparian vegetation.

Wildlife Area Units between Chico Landing and Colusa are bounded on the west by terrace deposits of the Modesto Formation and on the east by paleochannel deposits of a much older river system. Natural levees of loam material have developed along the main channel separating it from the natural flood basins on the east and west. Sediment texture is finer in this reach than the northern reach with more silty and sandy banks versus the more gravelly banks to the north. Columbia series soils, as mapped by the NCRCS, in the 1970's, are dominant in this area along with substantial areas of Riverwash. However, soil designations often change due to river channel migration and the creation of new floodplain. Updated soils maps will provide better planning information in the future.

Hydrology and Geomorphology – Stream flow is the primary controlling variable affecting the riverine environment. The natural disturbance regime of the river, the intra and inter-annual variability in the flow regime and all of its associated physical processes are the factors largely responsible for the mosaic of riparian vegetation communities along the river. In the Wildlife Area, and along the river in general, the preservation and restoration of physical processes is the key to successful long-term restoration of the ecosystem.

- ◆ **Channel Movement** - The processes of channel meander and avulsion, are the dominant process that shape the floodplain and associated natural communities along an alluvial river such as the Sacramento River. Meandering involves the river channel migrating laterally through the floodplain, eroding materials on the outside (concave side) of a bend in the channel creating nearly vertical cut banks, while at the same time depositing materials on the inside (convex side) of a bend creating point bars. This combination of erosion on the outside of bends and deposition on the inside results in the familiar meander form when seen on a map or aerial photo. Figure 3 depicts a typical bend on the river. Over time, this process of erosion and deposition continually creates new floodplain area and provides a variety of ecosystem niches for the associated riparian communities.

Channel avulsion also create a dynamic variety of landforms that sustain natural communities along the river. Although channel avulsion is a complex process, it can be described simply as the channel cutting off a bend that has become too tight to maintain. When a meander bend becomes too tight of a turn for the river to maintain, the river will create a straighter path for itself. Recent analysis has

identified at least a third of the riparian communities on the Sacramento River result from this process (Greco, 2000).

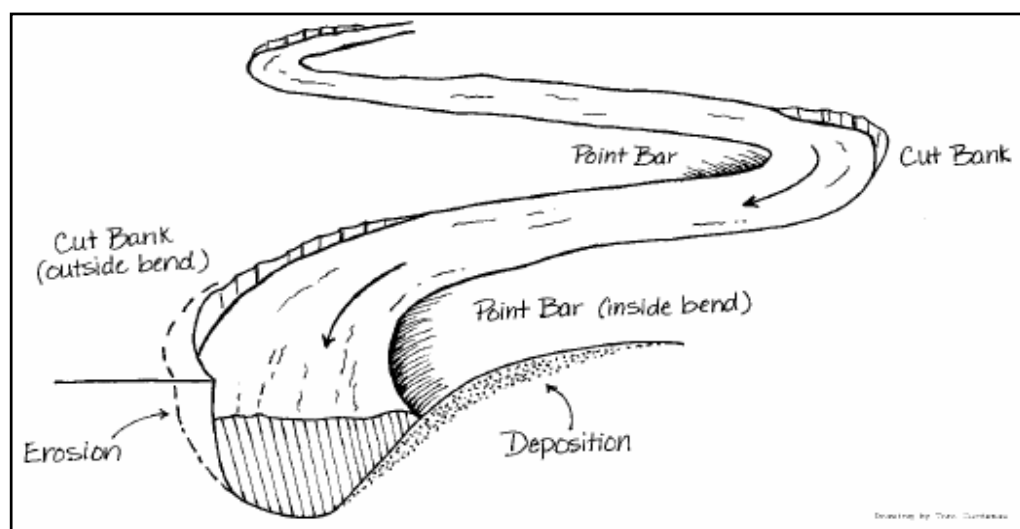


Figure 3. Typical Bend on the Sacramento River

* Illustration from the *Sacramento River Conservation Area Handbook*.

This process leaves evidence on the floodplain in the form of oxbow lakes and sloughs. A slough results from a relatively recent avulsion, where the channel has filled one end in with sediment, generally the upstream end, leaving the bottom or downstream end connected to the river. As more time passes, this bottom end eventually fills in as the river channel moves away from it creating an oxbow lake.

A 150 year meanderbelt has been described and mapped by the Department of Water Resources for the Sacramento River. This meanderbelt includes the location that the river channel has occupied in the last 100 years (moving both through meander and avulsion), and where it is projected to occupy in the next 50 years. The science of geomorphology does not yet have the predictive capability to designate exactly where the channel may be in the future. Channel movement can be either incremental or more sudden and this is controlled by the interaction of many complex physical factors. Therefore, the 50-year projections are approximate yet still of great value for large-scale planning. The location of the Units in the Wildlife Area is focused on this meander belt where the continuity of riparian habitat is critical to many wildlife and fish species.

Within the meanderbelt, the constant movement of the channel can greatly change the configuration of property. Figure 4 depicts the change that has occurred at RM 183 where the Ord Bend Unit of the Wildlife Area is located. The main river channel moved approximately one mile to the west between 1896 and 1908 as the result of avulsion. An oxbow lake known as "The Lagoon" resulted from this sudden shift in the channel location. Since that time, the river has moved progressively east, eroding and redepositing the land area that is now the Ord Bend Unit. Similar substantial changes in the river channel location and

the resulting reconfiguration of the adjoining land areas have occurred throughout the Wildlife Area.

Bank protection or armoring has been extensively installed along the outside of meander bends in the past to try to halt erosion and protect existing land uses and investments including agriculture, buildings, pumping plants, bridges and other improvements. Bank protection typically involves stripping away existing vegetation and replacing it with riprap, a covering of large rocks or concrete rubble, set at a relatively steep angle. Bank protection alters the rate of channel movement both upstream and downstream. It often relocates and modifies patterns of erosion, but does not halt erosion. When the channel migration process is frozen in place at one bend by bank protection, the bend downstream or across the river may erode more rapidly than it would have otherwise (Sacramento River Conservation Area Forum, 2002).

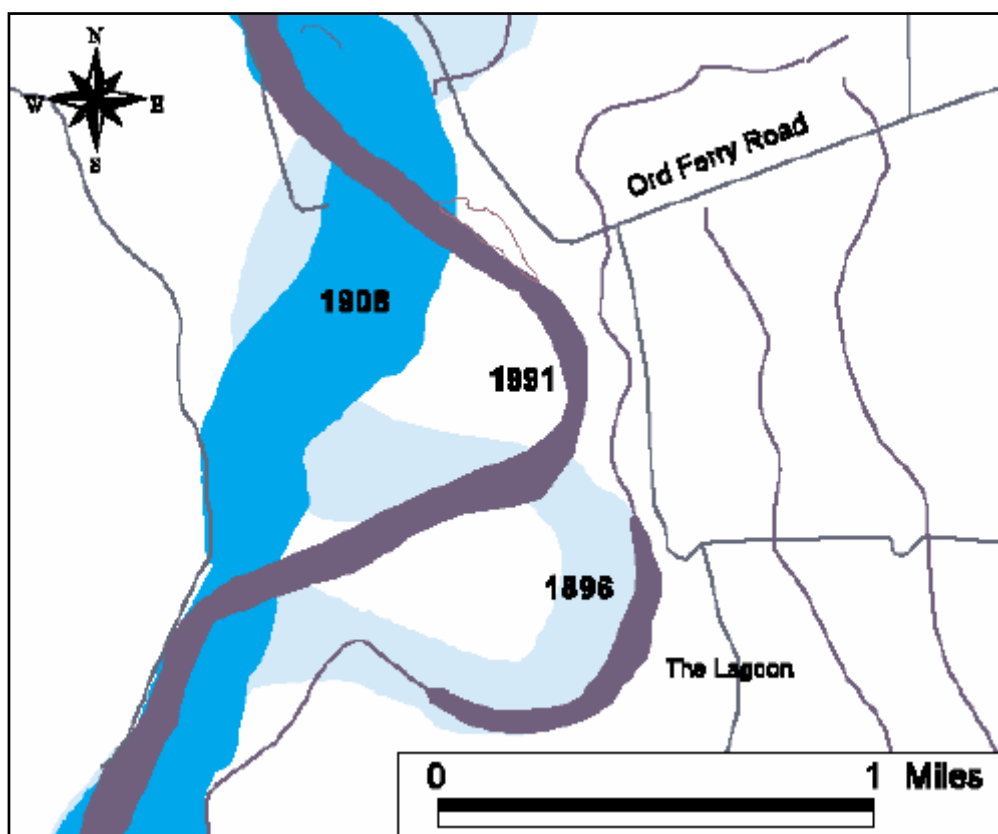


Figure 4. River Channel Movement at RM 183

* Illustration from the *Sacramento River Conservation Area Handbook*.

Bank protection has also been shown to have very substantial, negative impacts on wildlife and fish species. Site-level impacts occur that are directly related to the loss of vegetation and habitat where the bank protection is installed. An example is the loss of the cut banks that are required for bank swallow nesting. Substantial, reach-level impacts also occur. Bank protection halts the formation of new riparian forest and alters the sediment transport regime, a primary driving force in the overall ecological balance of the riverine ecosystem. Another major

impact is the loss of large woody debris, a key component of fishery habitat, in the river downstream of the riprap (U.S. Fish and Wildlife Service, 2000).

- ◆ **Sediment Transport** – Sediment transport is the process that supplies the source of materials for land and habitat building. The river works as a conveyor of sediment, transporting materials eroded from upper reaches and depositing them in lower ones. Material transported by the river includes various sizes of rock material, soil, fine vegetative matter and large woody debris. This material is generally deposited in the inside of meander bends, but it is deposited over a larger area of the floodplain in conjunction with flood flows.

The construction of Shasta Dam in the 1940's reduced the contribution of sediment from the upper portion of the watershed and modified the natural sediment transport regime. The exact status of the river in terms of sediment transport and balance is a matter of some scientific uncertainty, and additional research and information is needed before management conclusions can be drawn.

- ◆ **Hydrology and Flooding** – Hydrology and flooding are important factors in the creation and maintenance of riparian habitat. While Shasta Dam has substantially regulated the flow regime of the river from its natural conditions, the river still retains a level of its natural variability. This includes relatively frequent flooding of low lying floodplain areas within the meanderbelt. There are substantial unregulated tributaries below the Dam, which significantly contribute to the degree of natural variability that is still present within the flow regime. Although many aspects of the flow regime have been altered, such as the frequency, magnitude, duration, timing and rate of change, flooding as an important natural disturbance regime has not been eliminated. In part, it is this condition that makes this reach of the river such a priority for conservation. This river in the vicinity of the Wildlife Area still displays a level of function and ecological integrity as a result of this flow variability.

Most of the Wildlife Area is located in low-lying portions of the floodplain that are inundated every year or every two years on average. High Terrace areas of the Wildlife Area experience flooding with an average frequency of once every two to five years per the SRGIS. Flood flows within the Wildlife Area deposit sediment over the portion of the floodplain that is inundated, building up the level of the land. The sediment also provides mineral and vegetative matter to create and enrich the soil that sustains riparian vegetation. The plants that form the mosaic of riparian habitat have selectively adapted to and depend on this flood regime.

❖ **Sacramento River Flood Control Project**

The management of habitat in the Wildlife Area must be considered in the context of the Sacramento River Flood Control Project. The Army Corps of Engineers completed the project in 1968. The system was designed to provide flood damage reduction for 800,000 acres of agricultural land as well as the urban areas located in the floodplain. The system was also designed to increase the sediment transport capacity of the river in order to flush out large quantities of debris resulting from gold mining activities in the surrounding mountains. Overall, the flood control project mimics the spatial patterns of natural historic flood flows with a complex system of levees, weirs for diversion of floodwaters, offstream floodways and channel

modifications. Under natural conditions, a portion of these floodwaters was discharged from the river channel south of Chico Landing (RM 193) and flowed into lowland areas to the east and west. The Flood Control Project levees begin near the Ord Ferry Bridge (RM 184) and extend downstream to the mouth of the river. The *Sacramento River Conservation Area Handbook*, Chapter 2, contains an overview of the Sacramento River Flood Control Project. Much of the material within this section is adapted from the *Handbook* with the input of Department biologists and TNC science staff.

The Flood Control Project affects the natural river process in various ways depending on the location. The Project levees in the Wildlife Area are generally setback from the channel, accommodating continued channel meander where bank protection has not been installed. South of Colusa, and south of the Wildlife Area, the project levees, and often bank protection, are directly adjacent to the river channel, effectively limiting channel meander and the natural process of habitat formation and maintenance. The continued viability of a limited channel meander in the vicinity of the Wildlife Area is a major functional component of ecological integrity. The Flood Control Project serves a large area and flood damage reduction is an important State and local priority. Therefore, the impacts of the system upon the riparian habitat must be considered as part of an Ecosystem Approach to habitat management.

The Reclamation Board of the State of California is charged with the responsibility of maintaining the integrity of the Sacramento River Flood Control Project. The Reclamation Board reviews proposals for physical change within the “Designated Floodway” to ensure that such projects will not cause new flooding problems. This review is applicable to some improvements within the Wildlife Area such as planting to restore riparian habitat. All Department projects requiring such review are submitted for the Reclamation Board approval to ensure that they do not decrease the integrity of the flood control system.

❖ **Sacramento River Bank Protection Project**

To support the objectives of the Sacramento River Flood Control Project the Sacramento River Bank Protection Project was authorized in 1960 and a second phase was authorized in 1973. The purpose of the project was to reduce the need for emergency levee repair, periodic dredging, and loss of land area due to channel meander. This was to be accomplished by bank stabilization that typically involved stripping away existing vegetation and replacing it with riprap. Eventually, the serious ecosystem impacts of bank protection became an issue and all of the authorized bank protection sites were not completed. Recreationists and conservationists objected strongly to the losses of fish, wildlife and aesthetic resources that occurred from riprapping. Additionally there were concerns that bank protection could act to transfer erosive impacts to different property.

In addition to bank protection that has occurred as part of the Sacramento River Bank Protection project, substantial areas of river bank have also been modified through private landowner projects. Concrete rubble has often been dumped over eroding banks and other materials such as car bodies have occasionally been utilized in the past. Generally, these projects have occurred without required review or permits from the Reclamation Board and the U.S. Army Corps of Engineers.

Direct impacts occur to relatively small-scale areas when native vegetation is removed from the project levee or riverbank and replaced with rock. More importantly, long-term and much larger scale impacts to the overall ecosystem result

from halting the process of river channel meander. As described above, this meander is one of the fundamental processes that creates and maintain the diverse mosaic of riparian communities. There remains, however, strong interest in developing a more comprehensive program which would not only protect the levee system but could also preserve the riparian environmental values (Sacramento River Conservation Area Forum, 2002). The conflicting objectives of bank protection and the protection of wildlife habitat and Special Status Species are not yet resolved.

❖ **Cultural Resources**

The Wildlife Area undoubtedly contains cultural resources from the prehistoric and historic periods. In order to evaluate the existence and significance of such resources, a cultural resources analysis of the Wildlife Area was conducted as part of the Planning Process. This evaluation was performed by Peak & Associates in 2003 and it included the following components:

1. A review of existing records to determine if any known cultural resource locations were within the boundaries of the Wildlife Area.
2. A sensitivity analysis of the potential for cultural resources for each Unit and Subunit of the Wildlife Area.
3. An explanation of the actions that should be taken if cultural resources are discovered in the Wildlife Area in the future.

The complete text of the Cultural Resources Analysis is contained in Appendix G.

In summary, the analysis concluded that there were no recorded cultural resources sites recorded within the Wildlife Area. The report noted that about half of the Units have been substantially disturbed by channel meander over the past century, such that these sites have a low sensitivity for cultural resources. The remaining sites have a moderate sensitivity for such resources and detailed field evaluation of these sites was recommended prior to management actions that will include substantive physical change to the property.